Dallas Microcontroller Starter Kit

For the DS80C320/DS87C520

USER GUIDE

(Version 1.00)

CE

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Electromagnetic Compatibility (EMC) Compliance

The Dallas 87C520/80C320 Programmer is a CE Approved Product. It is designed only for use in a development environment only. This means that the user must ensure that there is no possibility of damage from electrostatic discharge (ESD). Since the devices and equipment to which this product is likely to be connected may well themselves be susceptible to ESD, this should not pose any difficulty.

For example, if you are handling microcontrollers and EEPROMS etc. then you will already be used to appropriate precautions, such as the use of anti-static mats, wrist straps and so on. You should treat your Dallas 87C520/80C320 with the same care as you would these type of device. Always ensure that you are not yourself carrying a static charge before handling the product. Wearing an earthed anti-static wrist strap is recommended.

Equinox have taken great care in designing this product to be compliant with the European EMC directive. When using the equipment be sure to follow the instructions provided. Although RF emissions are within prescribed limits, care should be taken if you are using the product near to sensitive apparatus. If you experience any difficulty please refer to Equinox technical support.

ESD Points to remember

- Work in a static-free environment.
- Wear an earthed wrist strap when handling either the programmer and/or any programmable device.

Please Note:

This equipment is NOT designed to be used in a production environment.

Technical Support

It is often the case that users experience problems when installing or using a product for the first time. Due to the low-cost nature of this product, Equinox are unable to answer technical support questions about this product or its use by telephone.

If you have a technical support problem, please consult the following list for help:

1 This manual

2 Troubleshooting Guide (see page 17)

3 On-line help

The Keil PK51-2K IDE (µVision and dScope) feature on-line context sensitive help. Press <F1> for help at any time.

Simply press <F1> on any error message and the possible causes of the error should be listed. This help system is updated on a regular basis. Please see software update details for information on keeping up-to-date with software revisions.

4 Internet Web Site

i Equinox Web site
The microcontroller support page can be found at: ***www.equinox-tech.com*** or

ii Keil On-Line Technical Support Database
Keil operate a 'Technical Support Database' on their website which provides up-to-date answers to real technical support questions: ***www.keil.com***

5 E-mail

Please e-mail any technical support questions about this product to: ***ds520@equinox-tech.com***

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Equinox will try our best to answer your questions about this product as quickly as possible. However, we can not promise an immediate reply. Please consult our web site for new software updates as the problem that you are enquiring about may have already been fixed in a new version.

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For technical support on this product please e-mail us at: ds520@equinox-tech.com

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About Dallas Microcontrollers

Dallas Semiconductors™ High speed microcontroller is an 8051-compatable device that provides improved performance and power consumption. The fundamental innovation of the high speed microcontroller is the use of four clocks per instruction as compared to twelve with the original 8051, This results in an up to three times improvement in performance.

Recommended Reading

1 Keil Reference Manual Set
Set of manuals for the PK51 (C51, A51 & Utilities)
Order Code: PK51-MANUALS

2 Equinox Guide to C and the 8051
Order Code: BK-C51-1

3 Dallas 520 Microcontroller Data Book
(Included with kit)

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Introduction

This CE compliant starter kit provides a suite of development tools for the DALLAS DS87C520 and DS80C320 microcontrollers. These microcontrollers support the standard 8051 instruction set but provides the speed of a 16 bit processor. They feature 2 full-duplex hardware serial ports and four 8-bit I/O ports. Also included in the kit is the powerful KEIL PK51-2K Integrated Development Environment (IDE) featuring an Editor, Macro assembler, C Compiler, Linker, software simulator and Hex creator.

This toolset allows up to 2K of program code to be written for a Dallas 320/520 derivative. The development board allows this code to be downloaded in 'real-time' from the IDE into external memory and run 'live' on the board. It is possible to set breakpoints and single-step the user program using this system.

NOTE a copy of "BLINKY" is now supplied on floppy disk with the kit if you don't feel like keying it in for yourself.

DALLAS DS80C320/DS87C520 PROGRAMMER HIGHLIGHTS

- State-of-the-art Device Programmer
- Supports
  Dallas 80C320 microcontroller
  Dallas 87C520 microcontroller
- Connects to spare PC Serial Port
- Straightforward hardware/software installation
- Code can be downloaded from PC to Target System in Real Time
- Break points can be set
- Can be single stepped

Device Support

DALLAS Microcontrollers

DS80C320

High speed microcontroller with the following features:

- Standard 8051 Instruction Set
- Four 8-bit I/O ports
- Three 16-bit timer/counters
- 256 bytes scratchpad RAM
- Multiplexed address/data bus
- Addresses 64KB ROM and 64KB RAM

DS87C520

High speed microcontroller with the following features:

- Standard 8051 Instruction Set
- 4 8-bit I/O Ports
- 3 16-bit timer/counters
- 256 bytes scratchpad RAM
- 16KB on-chip EPROM (OTP)
- 1KB extra on-chip RAM for MOVX

ROMSIZE™ Feature

- Selects effective on-chip ROM size from 0 to 16KB
- Allows access to entire external memory map
- Dynamically adjustable by software
- Useful as boot block for external FLASH

Please Note: The PK51-2K Toolset is also capable of generating up to 2K of code which can be placed in internal code memory of the microcontroller. A separate 'parallel' programmer and the use of the 87C520 EPROM/OTP device would be required. (Not supplied with the system).

System Specifications

DALLAS STARTER KIT SPECIFICATIONS

Programmer Size	: 170 x 100 x 15mm
Shipped Weight	: Approx 0.50kg
Shipped Size (Box)	: 315 x 205 x 115mm
PC Connection	: Serial Port 9-pin female D Connector or 25-pin adaptor supplied
Power Supply	: 9V DC supplied with kit. Lead centre +VC

KIT CONTENTS

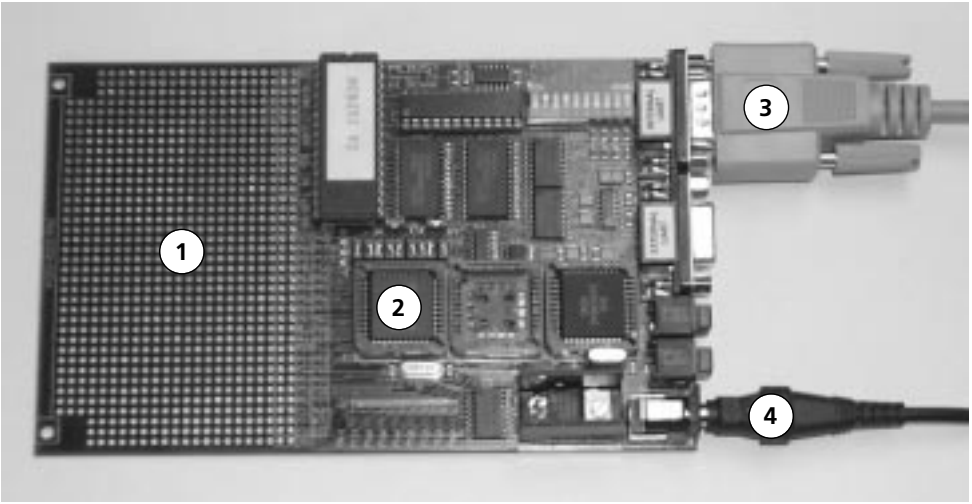
- MCB251 Board (8051 Monitor Module)
- Keil PK51-2K Software (2 Floppies)
- Serial Cable
- 9-25way adaptor
- Power Supply
- 1 Keil Evaluation Board Manual
- 1 Keil Evaluation Kit Manual
- 1 Dallas High-Speed Microcontroller Data book
- 1 Dallas Data Book and CD-ROM
- Keil CD-ROM
- 1 Floppy containing 'BLINKY' project
- 1 User Guide
- 1 Registration Card
- 1 PK51 Product Overview

MINIMUM PC REQUIREMENTS

The minimum hardware and software requirements to ensure that the programmer operates correctly are as follows:

100% IBM compatible 386+
Windows 3.1 or higher
Minimum 4MB RAM
Minimum 1MB free hard disk space
Spare PC serial port

Hardware Overview



Key

1 Prototyping Area
2 Dallas DS80C320 microcontroller
3 Serial Cable to P.C.
4 Power Lead (9V DC)

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Software Overview

The KEIL PK52-2K software supplied with this kit contains powerful development tools to program test and debug DALLAS microcontrollers.

Please consult the KEIL evaluation manual supplied with this kit.

Hardware Installation Instructions

OVERVIEW

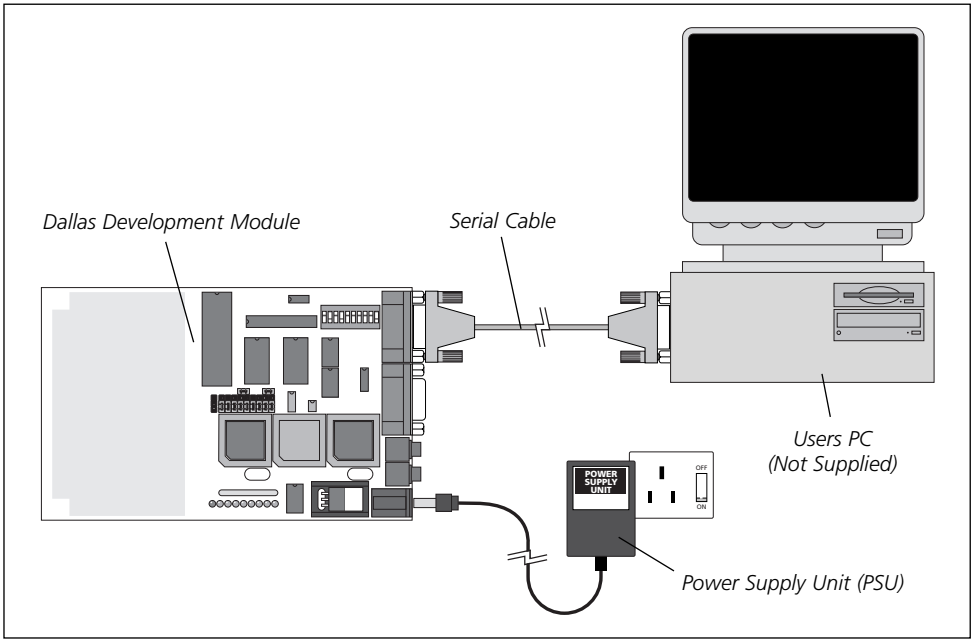
The Dallas programmer connects to any spare PC **serial** (COM) port. If you only have one serial port and this is in use for eg. a modem, it may be possible to add another serial port to your machine by inserting a new I/O card.

For further hardware installation help, please refer to the: **Installation Troubleshooting Guide.**

Connect the programmer to the PC as follows:

1 Plug Dallas Development Module into spare PC serial port.

2 Apply power to the target board.



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Blinky Flashing LED Project

Introduction

In order to help you become familliar with this product the following project guides you through the installation of the Keil PK51-2K software and the steps needed to generate a working program.

Blinky Example Program

The following simple program "BLINKY" is an exercise you may use to test the kit and verify that you can use the tools provided.

Hardware Requirements

- DALLAS 87C320 starter kit.
- A PC with Windows 3.1, Windows 95 or Windows 98 with an available RS-232 port.
- If the port has a 25 pin connector an adapter is supplied with the kit.

Connect the board as shown in Fig 1.

Jumper Settings

As shown in Figure 1.

DIP Switch Settings

Set the DIP switch settings to:

1,3,5,6,7,8 & 9	ON
2,4 & 10	OFF

Software Installation

With Windows loaded, insert PK51-2K disk 1 and from the RUN menu type a:\setup click O.K. Follow the on-screen instructions. Before re-starting the computer remove the floppy disk. The Keil installation program creates a 'Program Group' as shown in Figure 2. The software should also be installed on the 'Start' menu.

Figure 1 Connections.

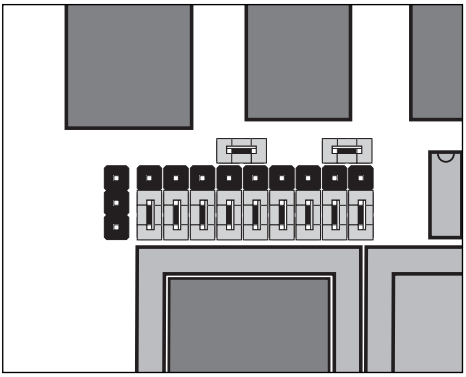
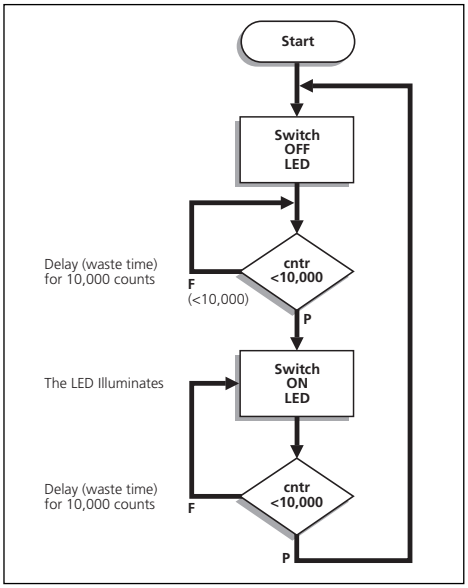


Figure 2 Start up screen.

Blinky Flashing LED Project Continued



Creating your first project

Double Click on **µVision-51**

or select <Start><Program>
<Keil PK51-2KB><µVision-51>

When µVision starts, select the <NEW> command from the
drop down File menu. µVision opens a new test window in which you may create the "BLINKY" program.

Enter the "BLINKY" program as shown in Figure 3b.

NOTE *to save you time the program is a supplied on a floppy disk.*

Figure 3a. flowchart for program

```
// blinky.c led flasher

#include <reg320.h>    //Includes register declarations for the Dallas DS320/520 microcontrollers

sbit LED = P1^3;       //Assigns the label 'LED' to Port 1 bit 3

unsigned int cntr;     //counter variable

void main (void)       //Declares start of  'main' function
  {
  while(1)             //Start of  'while' loop
    {
    LED = 1;

    for  (cntr=0; cntr<10000; cntr++)   //Delays for 10000 counts
    {;}

    LED = 0;

    for  (cntr=0; cntr<10000; cntr++)  //Delays for 10000 counts
    {;}
    }                  // End of  'while' loop ñ jumps to start of 'while loop

  }                    // End of 'main' function
```

Figure 3b program text.

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Blinky Flashing LED Project Continued

Your screen should look something like Figure 4.

Click on <File>, <Save as> and name the file BLINKY.C see Figure 5.

Click <OK>. After saving BLINKY.C you should create a BLINKY Project File.

A Project File contains a list of all source files in your project as well as the options to use for the compiler, assembler, linker and make facility. Additionally the Project Manager helps you to compile, link and test your target program.

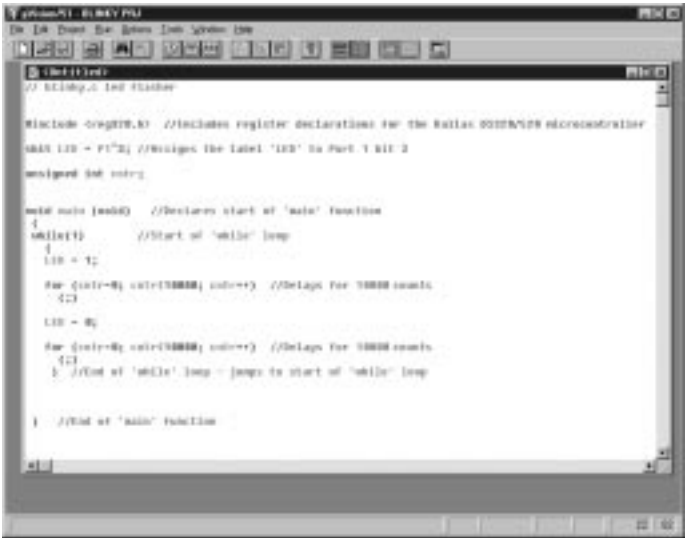

Figure 4 entered text.

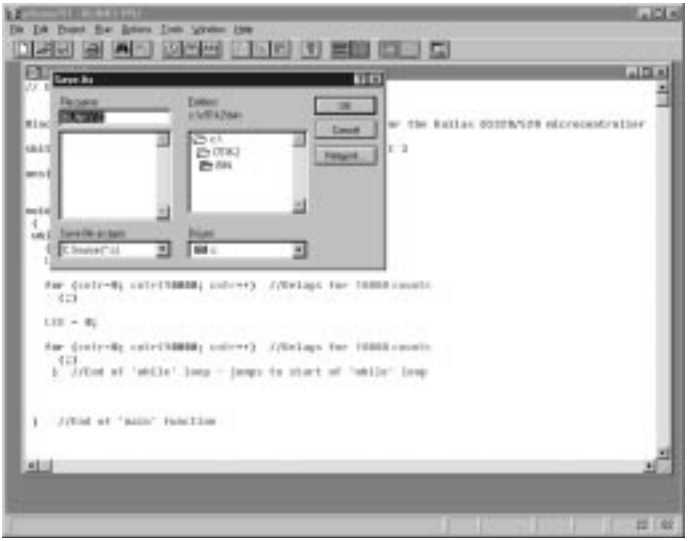

Figure 5

Blinky Flashing LED Project Continued

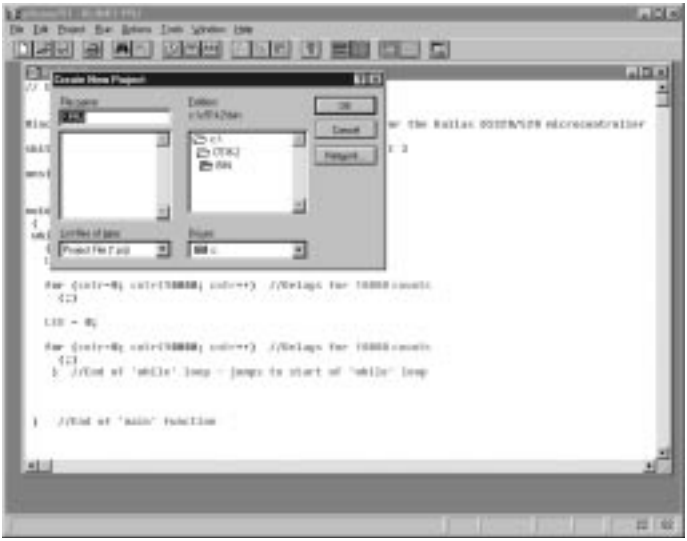

Figure 6

To create a Project File called 'BLINKY', click on the <New Project>... command from the <Project menu>, µVision displays the dialog box something like Figure 6.

Enter the name of the project in the <File name> box. This example uses BLINKY.PRJ. Click <OK>.

***NOTE** you must always use .PRJ as the file extensions for the project file.*

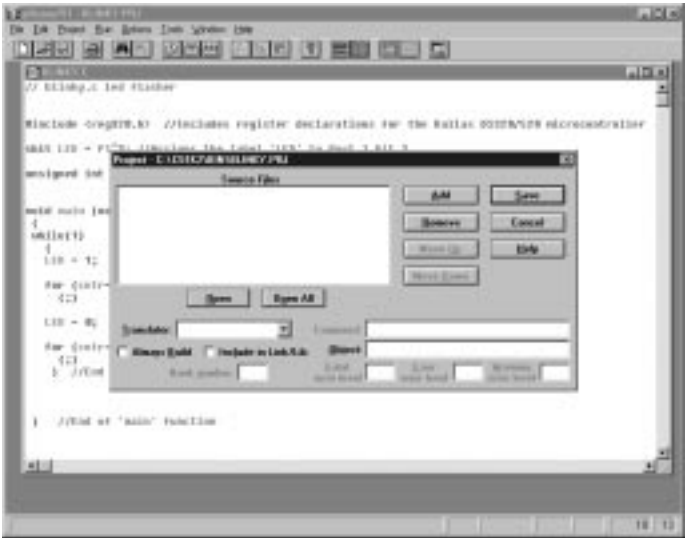

Figure 7

µVision displays a dialog box which should look something like Figure 7.

Click on <Add>. This brings up the <Add file> to <Project menu> as shown in Figure 8.

Make the File name blinky.c

Click on <Add> then <Close>. Click on <Save> to save the changes to the Project file.

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Blinky Flashing LED Project Continued

***NOTE** to return at any time to the Project Manager dialog box select the <Edit Program> command from the Project menu drop down box.*

When you have created a Project file and inserted the source files into the project, you are ready to set the options for the compiler, linker and other tools.

To set the C51 Compiler Options, select the <C51 Compiler> command from the <Options menu> µVision displays the C51 Compiler options. Select the <Object Tab>. Set the options for the BLINKY example:

- Include debug information
- Include extended debug information
- Enable ANSI integer promotion rules.

For Interrupt vectors select Include in object, Interval 8 and Offset 0. See Figure 9.

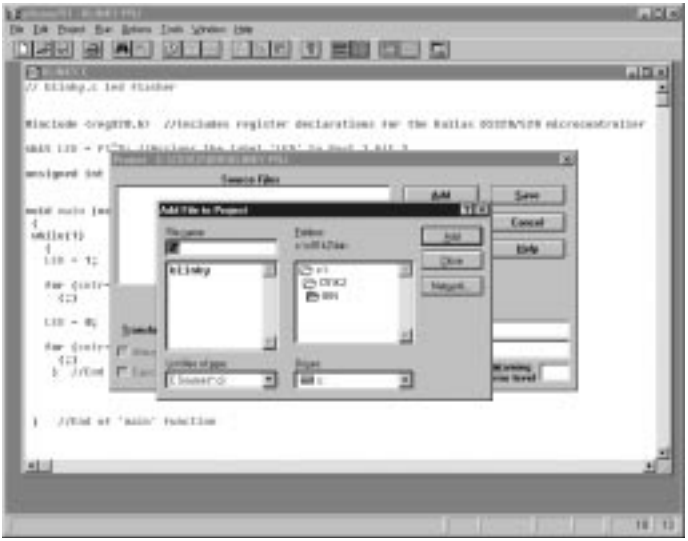

Figure 8

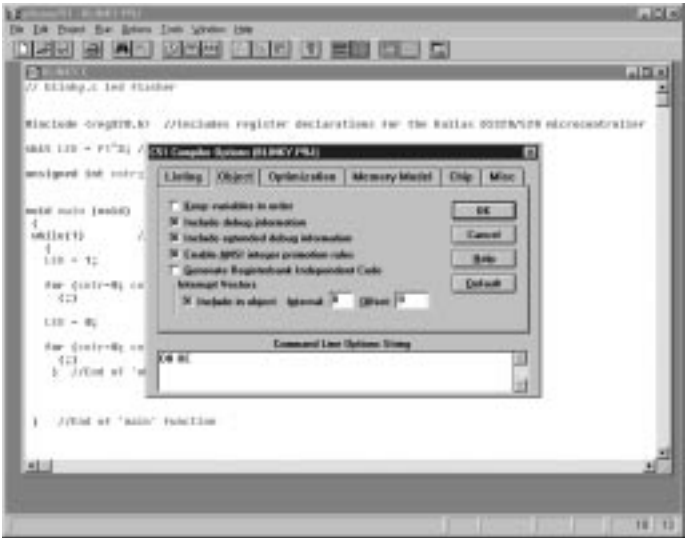

Figure 9

Blinky Flashing LED Project Continued

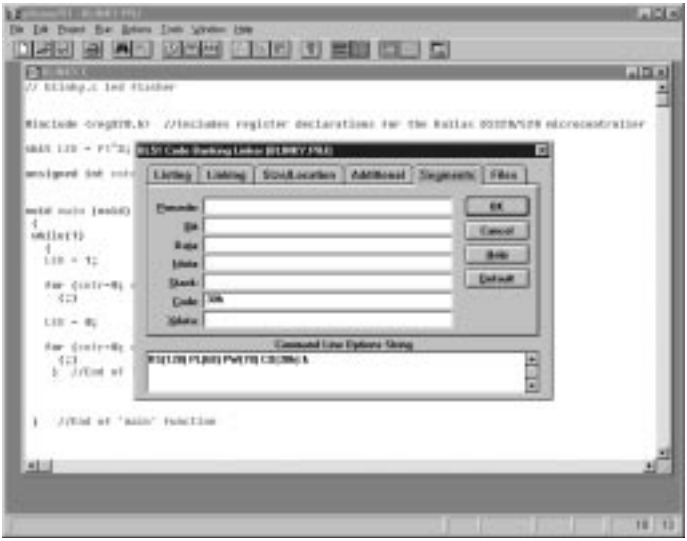

Figure 10

Click <OK>.

To select the Linker options:

Select <BL51 Code Bank Linker> from the µVision <Options> menu. Select tab and insert "30h" in Code. See Figure 10.

Click <OK>.
This reserves space for the interrupt vectors so the user program now starts execution from 30h.

Next you need to create a dScope file by selecting <New> from the File menu of µVision.

Enter the text as shown in Figure 11. Save file as DSCOPE.INI.

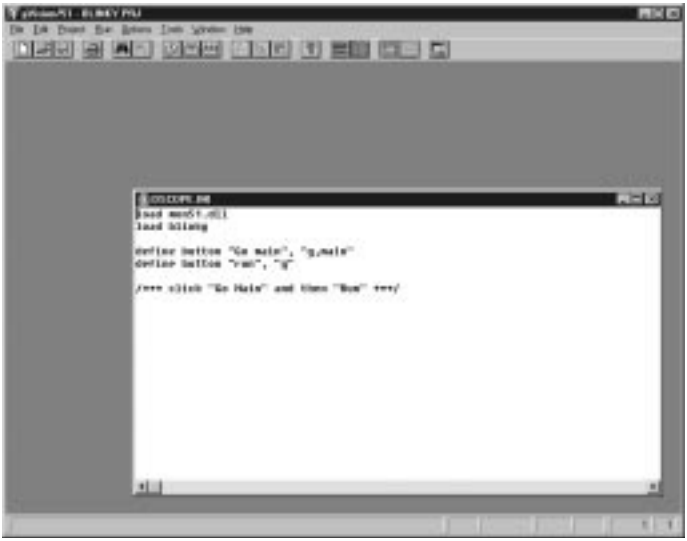

Figure 11

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Blinky Flashing LED Project Continued

The DSCOPE.INI window can now be closed. From the µVision <Options> drop down menu select <dscope Debugger>. Now enter the name DSCOPE.INI. See Figure 12.

Click OK.

You are now ready to compile BLINKY. Click on the <Build all> icon. The screen should now look something like Figure 13.

If errors are detected Click OK, a list of errors will be displayed. The errors must be corrected and the program recompiled by clicking on the <build all> icon again.

Click <OK>.

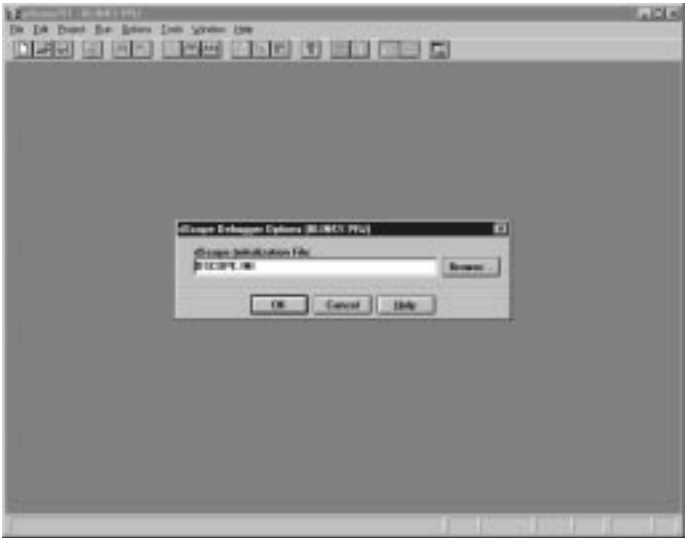

Figure 12

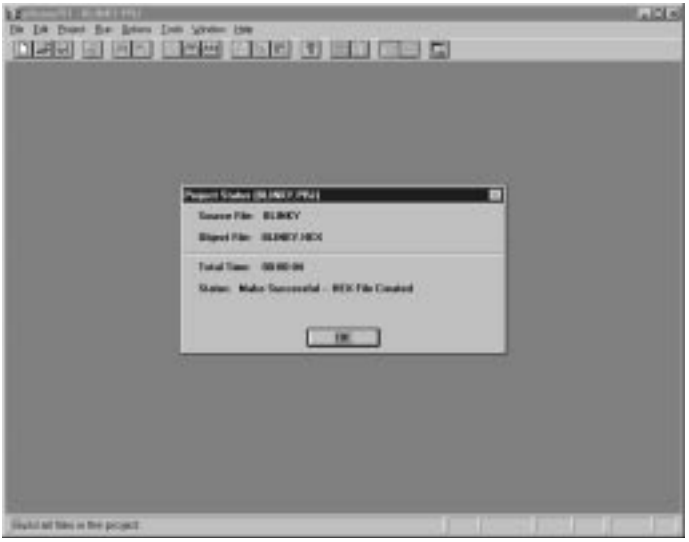

Figure 13

Blinky Flashing LED Project Continued

Running 'BLINKY' on the Dallas 320 module...

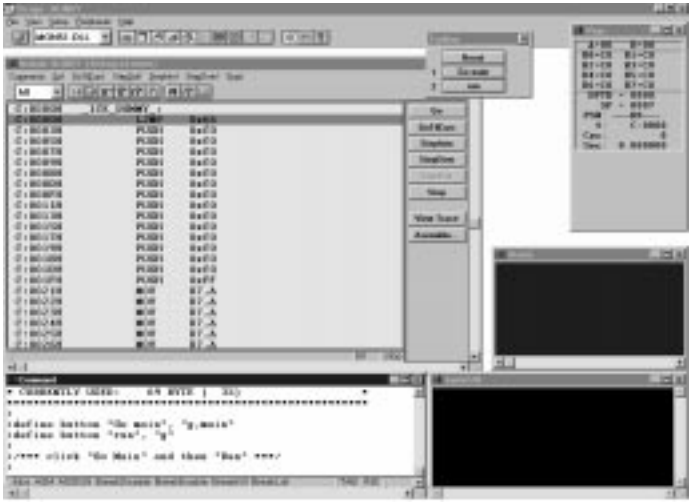

Figure 14

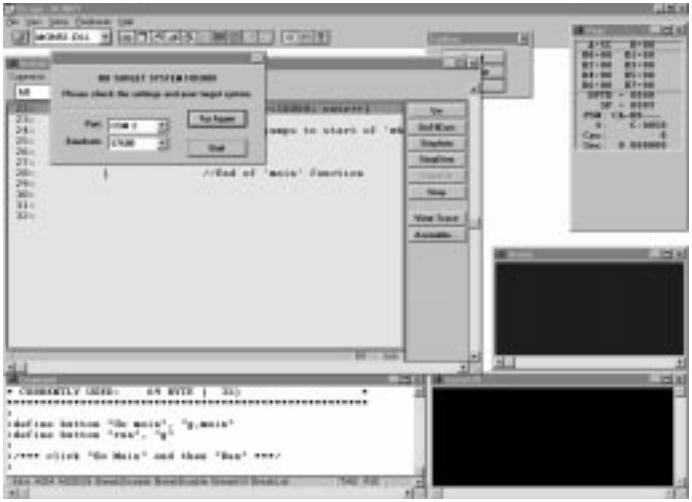

Figure 15

At last you are ready to test the project. From the µVision window click on the <Debug> icon. You should get a display looking something like Figure 14 or Figure 15.

You must set the baud rate to 19200 and the comm port to the port you are connected to on your computer.

Note. If the debug window does not appear click on <View> then <Debug window>. Try again.

You should now have a display something like Figure 15. Click on <Configuration> on the <Peripherals> menu and set <Use serial interrupt> to 'ON', select <Apply> then <Close>. See Figure 16.

To display the dialog bar turn on <Show Dialog bar> in the <Commands> menu. You should be able to start and stop the program by clicking on Go and Stop.

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Blinky Flashing LED Project Continued

As a hardware engineer I am sure I could find an easier way to flash an LED!

Now would be a good time to try setting breakpoints. Try double clicking on the lines of code LED = 1 and LED = 0. This will set breakpoints. Try clicking on Go a few times, this should change the state of the LED. To remove the breakpoints double click again on lines of code LED = 1 and LED = 0.

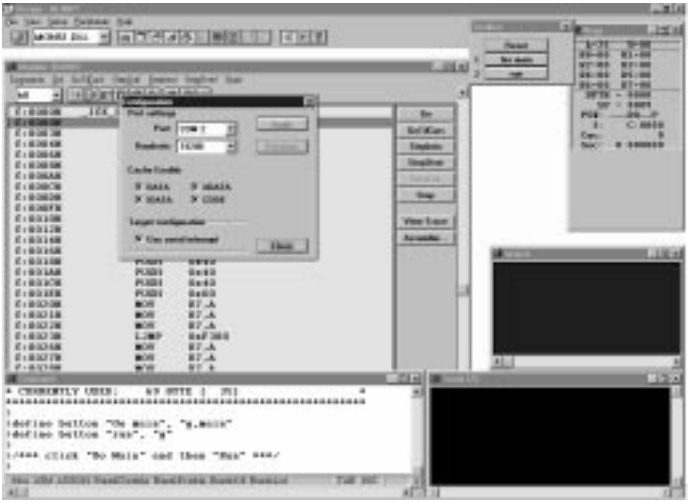

Figure 16

Testing 'BLINKY' using the simulator...

Bring up the Toolbox menu by Clicking on the <Toolbox> window icon. Click <Select> icon next to MON51.dll and select 80320.dll. Click on the <Peripherals> drop down menu and select <Port 1>. The Parallel Port 1 window will be displayed on the screen. See Figure 17.

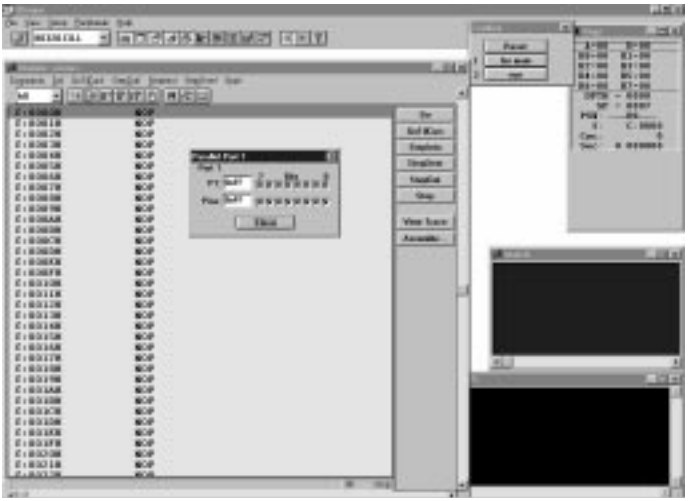

Figure 17

Blinky Flashing LED Project Continued

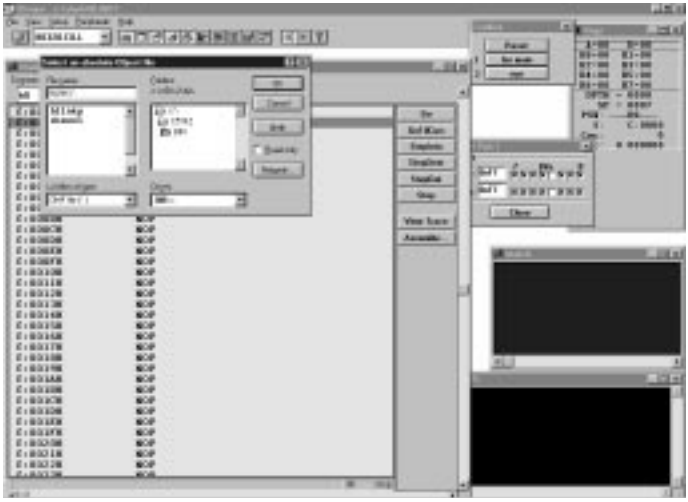

Figure 18

Move this window to the right of the screen to a position under the Toolbox window.

From the Toolbox window, Click on <File> and from the drop down menu click on <Load object file>. The "Select an absolute Object file" window should now be displayed. Click on BLINKY (no extension). See Figure 18.

Click <OK>. From the Toolbox menu, select <Go Main> followed by <Run>. The program should now be running. You should see bit 3 toggling in the parallel port 1 window.

Further example programs are available in the book "The EQUINOX Guide to C and the 8051"

(Not supplied with this kit)

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Troubleshooting Guide

1 Installation problems

- Does your PC meet the minimum PC requirements of this product?
- Do you have spare PC serial port?
- Have you connected the serial cable from the PC COM port to the Dallas programmer?
- Have you selected the correct COM port?
- Is the serial port already in use by another application?
- Have you applied power to the Dallas programmer?

Upgrades/Associated Products

1 A software upgrade is available from Equinox Technologies to upgrade from the PK51-2K to the PK51-8K *(More information about the 8K package can be found in the PK51 user manual)*

Order Code: **PK51-8K-UPG**

2 The Micro-PRO-Plus is available from Equinox Technologies, which allows downloading of the user program code into internal code memory.

Order Code: ..... **MPW-PLUS**

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